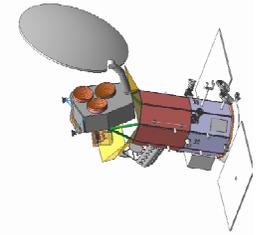
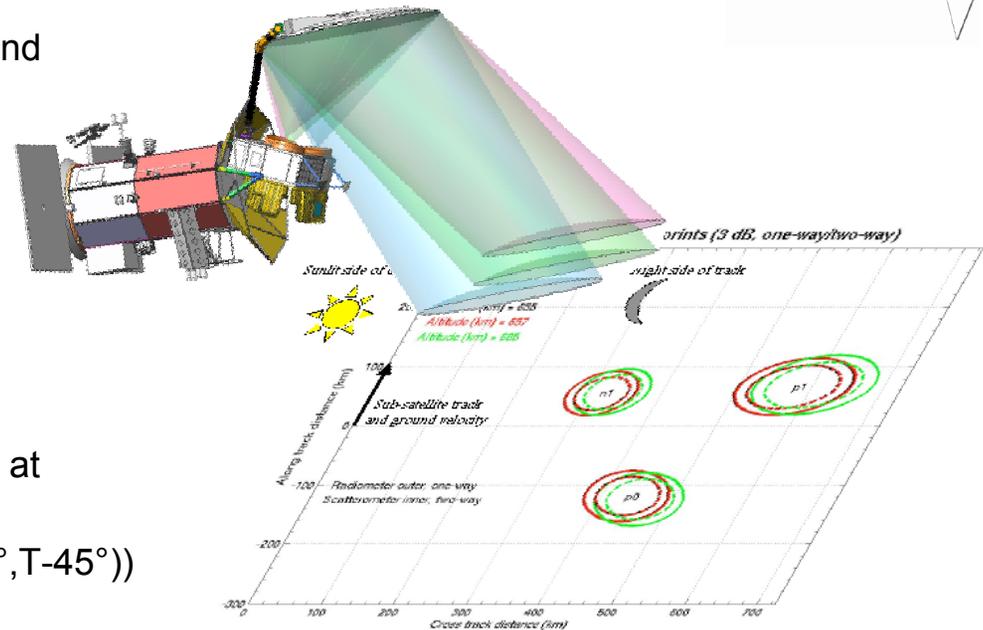


Selected Instrument Concept

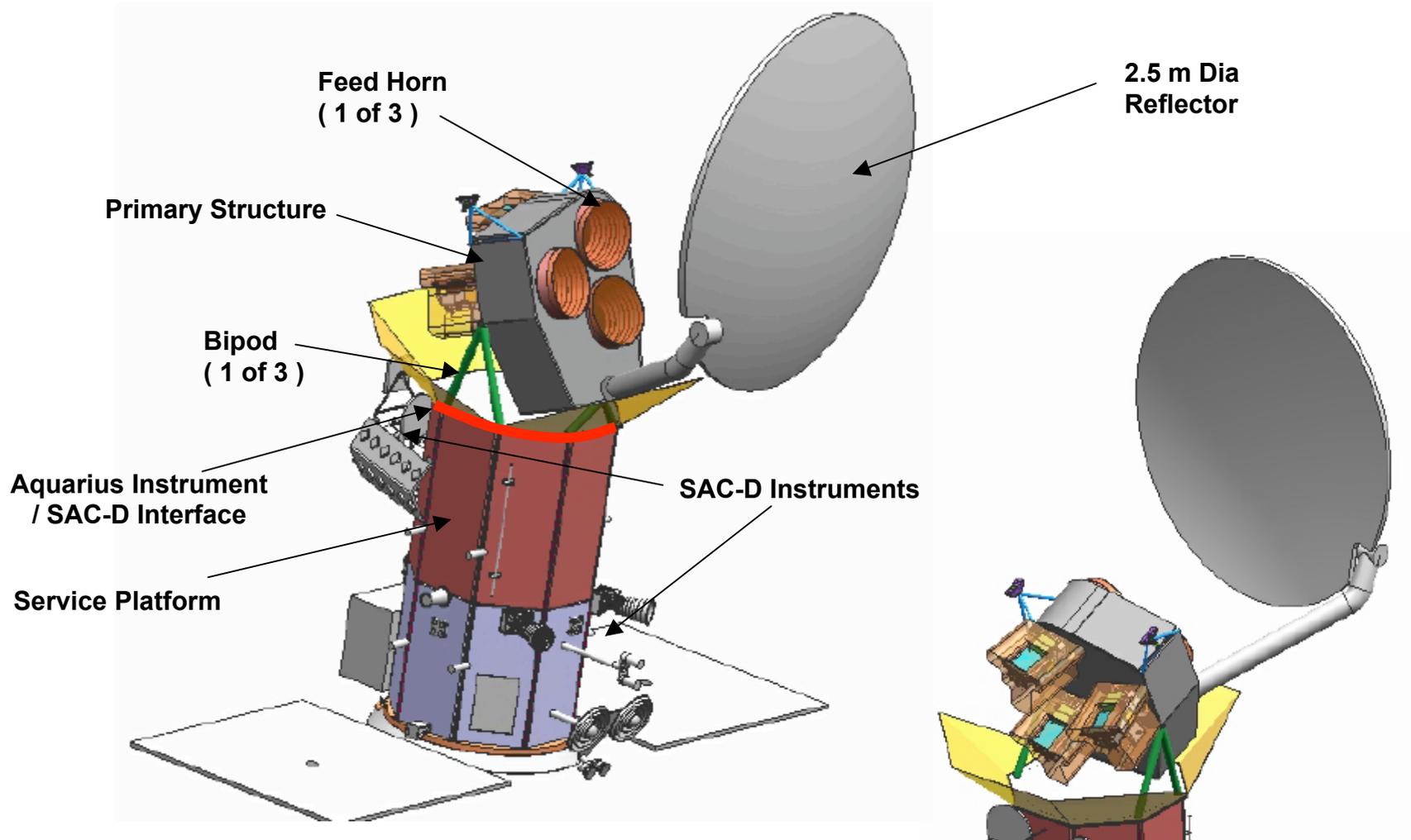
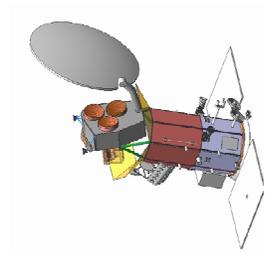


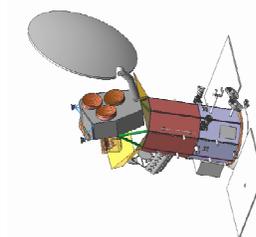
- Antenna
 - Radiometer & Scatterometer share feed and reflector (one antenna subsystem)
 - ≥ 2.5 m reflector diameter
 - Three feeds, in triangular geometry
 - Offset parabolic geometry
 - Three footprints in mechanically stable pushbroom configuration
- Radiometer
 - Radiometer ~ 27 MHz wide band centered at ~ 1413 MHz
 - Polarimetric radiometer (TH, TV, U (T+45°, T-45°)) for correcting for Faraday rotation
- Scatterometer
 - L-band, in space-radar band
 - Polarimetric (co-pol and cross-pol) for Faraday rotation correction and algorithm improvement
- ICDS (control and data system)
 - On-board storage, data processing
 - Interface with Service Platform



- Other
 - 3-year lifetime, single-string
 - 98 minute, sun-synchronous, 6 pm ascending orbit, 657 km equatorial altitude (655 km minimum, 685 km maximum over the orbit)

Observatory Illustration





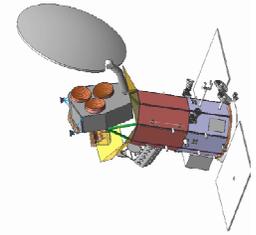
KEY ORBIT PARAMETERS

<i>Parameter</i>	<i>Value</i>
Observatory Orbit Altitude (km)	657 (655-685 km)
Orbit Inclination (deg)	98.0 (sun-synchronous)
Orbit Equatorial Crossing	6:00 PM ascending
Ground-track repeat interval	7 days, 103 orbits

KEY INSTRUMENT PARAMETERS

<i>Parameter</i>	<i>Radiometer</i>	<i>Scatterometer</i>
Frequency (MHz)	~1413	1260
Band Width (MHz)	≤ 26	4
Swath Width (km)	407	373
Polarization	Th, Tv, T+45, T-45	HH, HV, VV, VH
PRF (Hz)	100	100
No. Measurements Per Second	58.3	5.6
Transmitter Power (W)		200 - 250
Transmit Pulse Length (ms)		1
Pulse Integration Time (ms)	~9	~1.6
A/D (# bits)		12
Data Rate (kbits/sec)	11.0	2.1
Measurement Integration Time (s)	6	6
Dynamic Range (K, σ_0)	<5 K to 1400 K	0 dB to -40 dB

Key Parameters
6/20/05



KEY ANTENNA PARAMETERS

Parameter	Value					
Antenna	2.5 m diameter, offset parabola (2.5 x 2.9 linear dimension)					
Feedhorns	3 feeds, 50 cm diam, equilateral triangle about focus					
				(off-nadir pointing angle of 33°)		
Parameter	Radiometer			Scatterometer		
	Inner beam	Middle beam	Outer beam	Inner beam	Middle beam	Outer beam
Look Angle (deg)	25.8	33.8	40.3	25.9	33.9	40.3
Azimuth Angle (deg)	9.8	-15.3	6.5	9.7	-15.3	6.5
Average 3 dB Beam Width (deg)	6.1	6.3	6.6	6.5 / 4.7 *	6.7 / 4.8 *	7.1 / 5.1 *
Beam Efficiency (%)	94.0	92.4	90.4	89.9	87.6	85.4
Peak Gain (dBi)	29.1	28.8	28.5	28.5	28.1	27.7
Gain Stability (K, dB)	0.11	0.11	0.11	0.04	0.04	0.04
Peak Cross-Pole Gain (dBi)	6.5	8.6	10.3	6.3	8.4	10.1

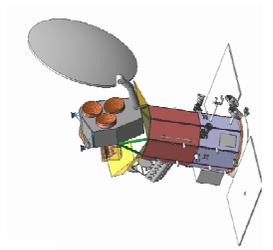
* one-way / two-way 3 dB beam widths

KEY MEASUREMENT PARAMETERS/REQUIREMENTS

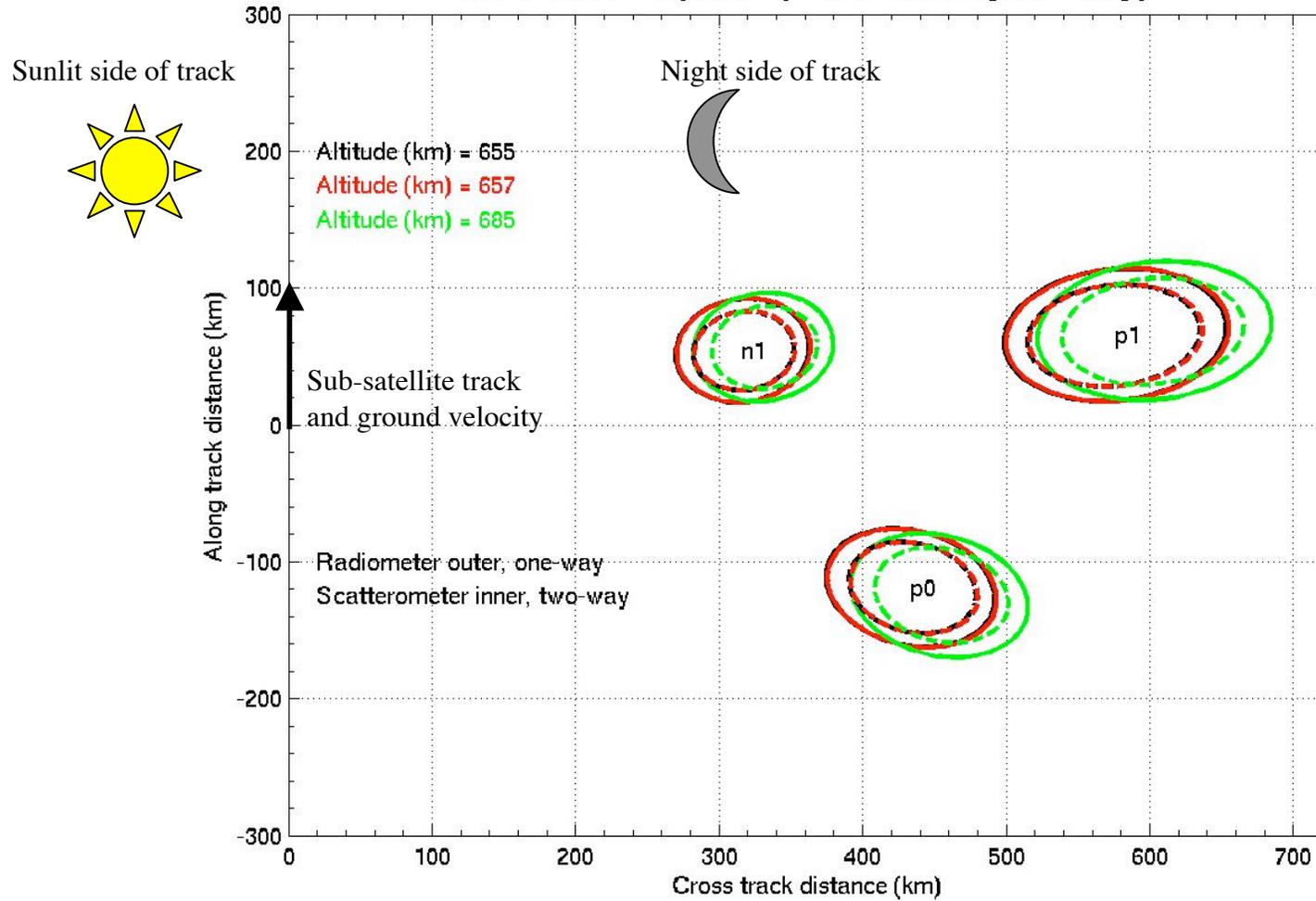
Parameter	Radiometer			Scatterometer		
	Inner beam	Middle beam	Outer beam	Inner beam	Middle beam	Outer beam
Incidence Angle (deg)	28.7	37.8	45.6	28.8	37.9	45.5
Footprint Size (3 dB one-way, two-way)	94 x 76	120 x 84	156 x 97	71 x 58	91 x 65	122 x 74
Noise-Equivalent Sigma-0 (dB, pulse)				-29	-26	-24
Stability (K, dB)	0.12	0.12	0.12	0.13	0.13	0.13
Radar Sensitivity (dB)				0.04	0.06	0.1
Radiometer Sensitivity (NEDT, K)	0.06	0.06	0.06			
Power Sensitivity (after integration) (dBm)	-137	-137	-137	-119	-126	-127

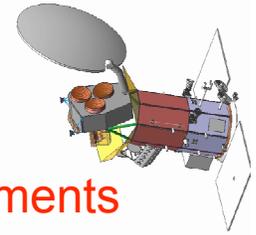
Note for reference: 0.1 K error for a 100 K T_B = 0.1 % => 0.004 dB error

Footprint Illustration



Antenna Footprints (3 dB, one-way/two-way)





2.5 m reflector (2.5 x 2.9 linear dimensions)
three, 50 cm diam feeds in triangle about focus

CBE footprints, swath width, gaps meet requirements

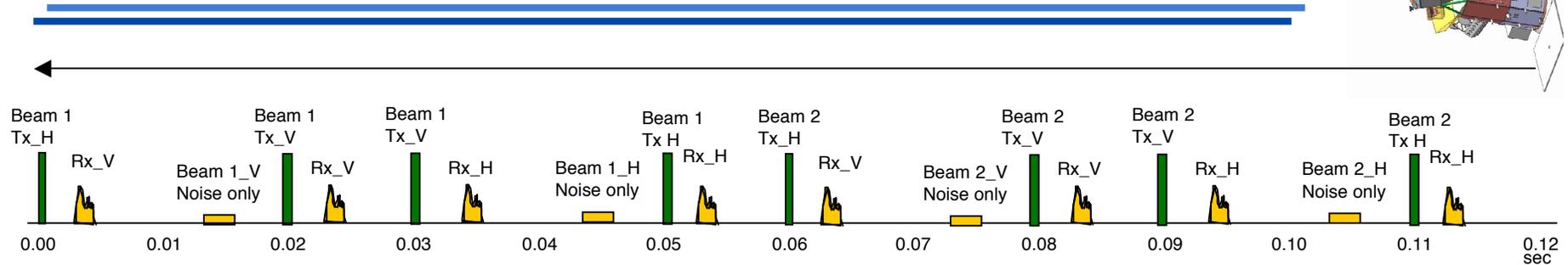
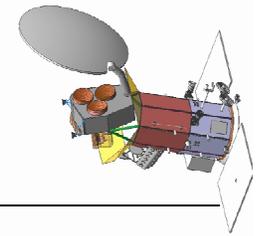
33° ptg angle	Radiometer			Scatterometer		
	Inner footprint	Middle footprint	Outer footprint	Inner footprint	Middle footprint	Outer footprint
Look angle (deg)	25.8	33.8	40.3	25.9	33.9	40.3
Azimuth angle (deg)	9.8	-15.3	6.5	9.7	-15.3	6.5
Avg beam width (deg)	6.1	6.3	6.6	4.7	4.8	5.1
Max beam width (deg)	6.4	6.7	7.0	4.8	5.1	5.4
Min beam width (deg)	5.9	5.9	6.2	4.5	4.6	4.8

Low altitude

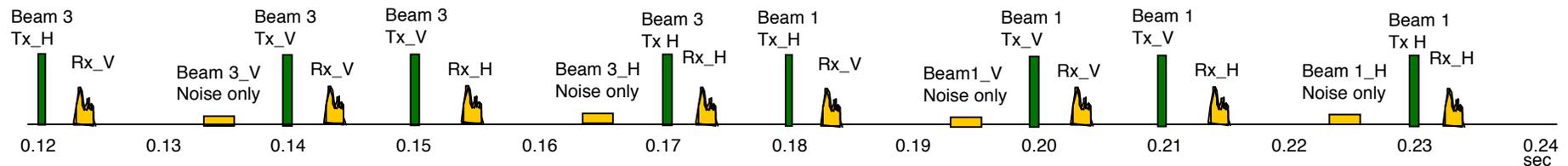
Altitude (657 km)	Radiometer			Scatterometer		
	Inner footprint	Middle footprint	Outer footprint	Inner footprint	Middle footprint	Outer footprint
Incidence angle (deg)	28.7	37.8	45.6	28.8	37.9	45.5
Footprint length (km)	94.2	120.5	156.5	71.1	90.7	121.6
Footprint width (km)	75.8	83.9	96.5	57.8	65.2	74.3
Footprint area (km ²)	5603	7940	11859	3227	4644	7100
Geometric mean ftrprt (km)	84.5	100.5	122.9	64.1	76.9	95.1
Arithmetic mean ftrprt (km)	85.0	102.2	126.5	64.4	78.0	98.0
Inner cross-track distance (km)	272	379	505	284	394	519
Outer cross-track distance (km)	365	495	661	354	481	640
Total swath width (km)	388.4			356.4		
Inner-middle gap (km)	14.2			39.9		
Middle-outer gap (km)	9.8			38.0		
Equatorial Inter-swath gap (km)	0.6			32.7		
Innermost incidence angle (deg)	25.1	34.0	41.4	26.0	35.0	42.3
Outermost incidence angle (deg)	32.3	41.7	49.8	31.5	40.9	48.8

High altitude

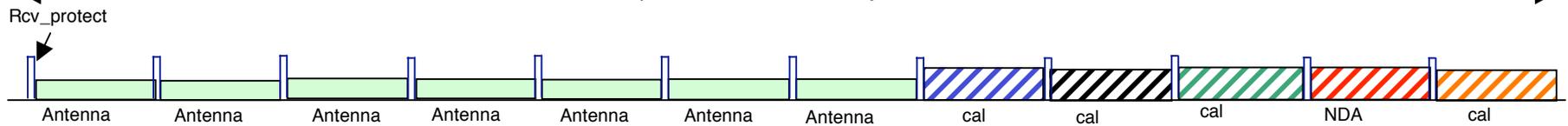
Altitude (685 km)	Radiometer			Scatterometer		
	Inner footprint	Middle footprint	Outer footprint	Inner footprint	Middle footprint	Outer footprint
Incidence angle (deg)	28.8	38.0	45.8	28.9	38.1	45.7
Footprint length (km)	98.3	126.0	164.1	74.3	94.9	127.6
Footprint width (km)	79.0	87.6	100.8	60.3	68.0	77.6
Footprint area (km ²)	6105	8671	12995	3516	5072	7779
Geometric mean ftrprt (km)	88.2	105.1	128.6	66.9	80.4	99.5
Arithmetic mean ftrprt (km)	88.7	106.8	132.5	67.3	81.5	102.6
Inner cross-track distance (km)	284	396	527	296	411	542
Outer cross-track distance (km)	381	517	690	369	502	669
Total swath width (km)	406.6			373.0		
Inner-middle gap (km)	14.8			41.7		
Middle-outer gap (km)	10.2			39.7		
Equatorial Inter-swath gap (km)	-17.6			16.0		
Innermost incidence angle (deg)	25.2	34.1	41.6	26.1	35.2	42.5
Outermost incidence angle (deg)	32.5	42.0	50.1	31.6	41.1	49.1



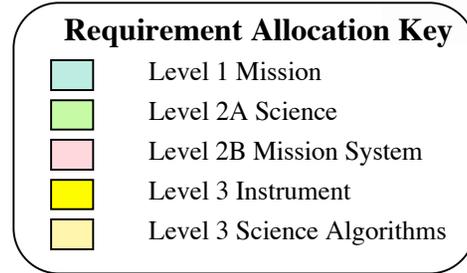
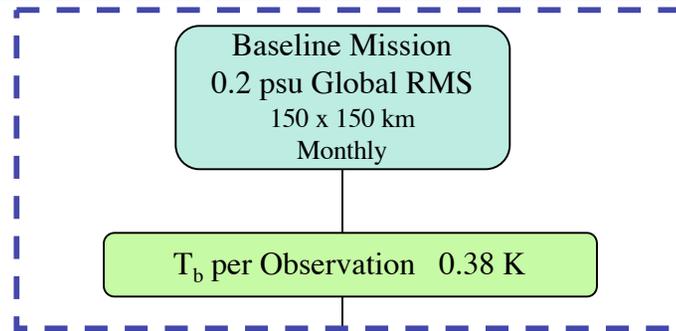
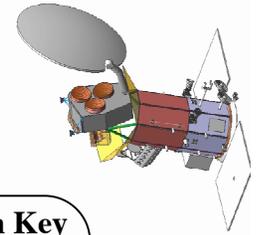
One Aquarius Scatterometer Timing Cycle, 180 ms



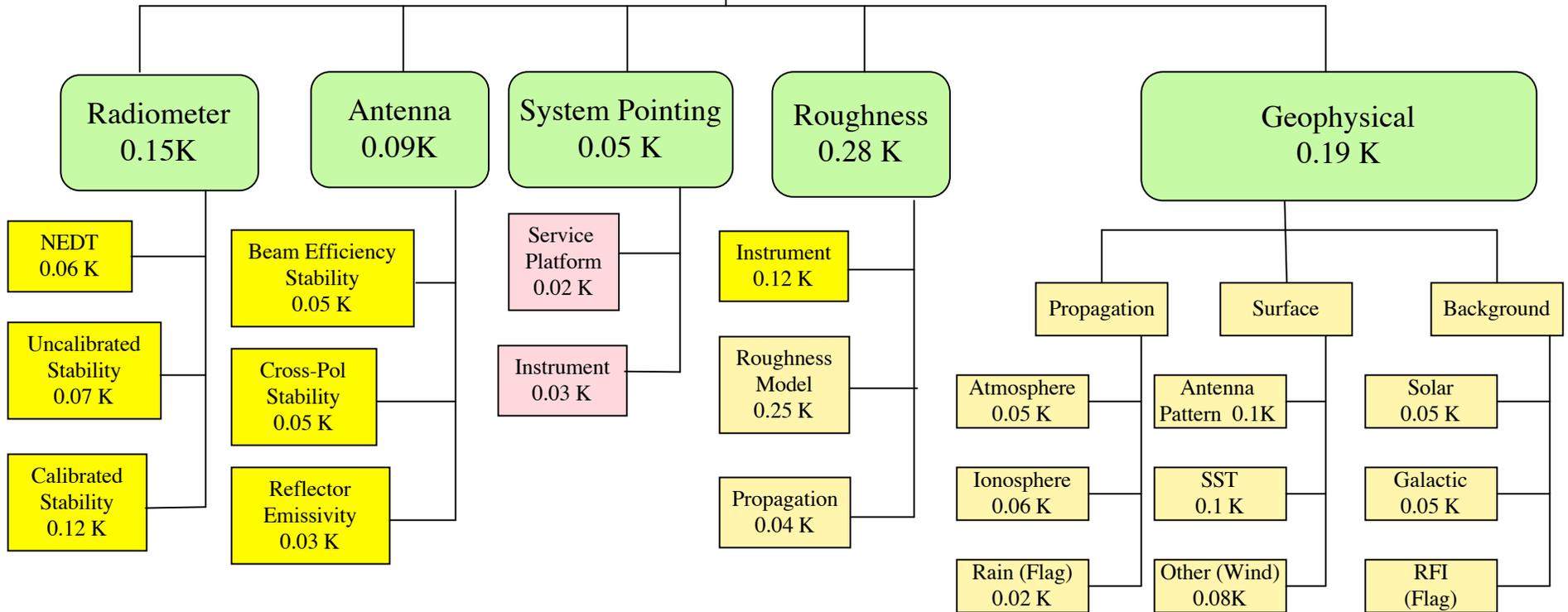
One Aquarius Radiometer sub-cycle, 120 ms

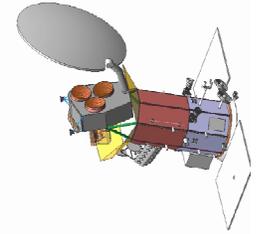


- Scatterometer sequence repeats every 180 msec and is fixed
- Radiometer sequence repeats every 120 msec
- Radiometer OMT noise diode is always fired during scat noise-only interval
- Radiometer is blanked during scat transmit event by way of a receive protect pulse



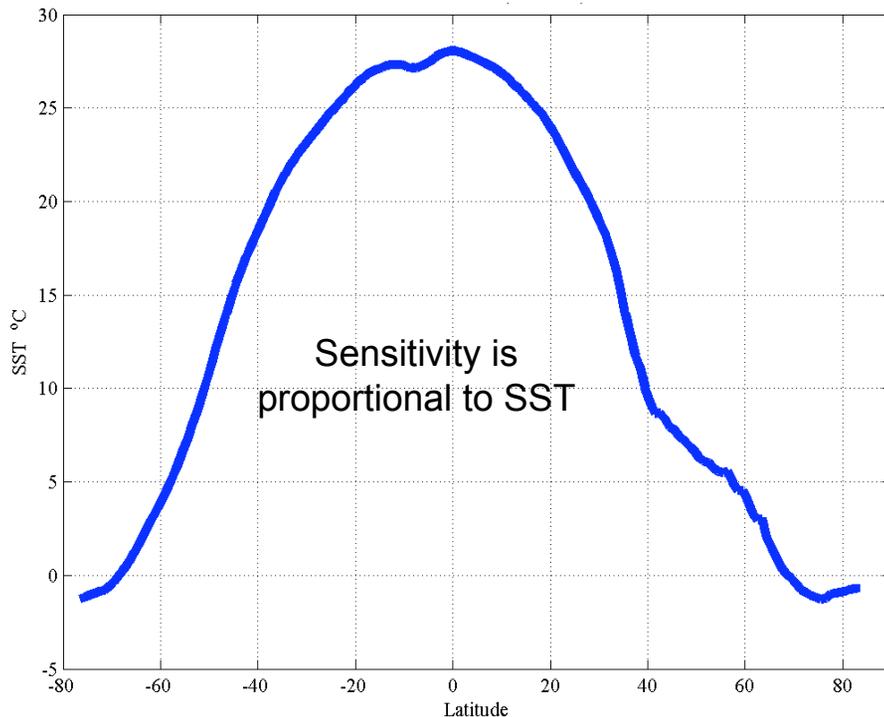
Level 2 Allocations



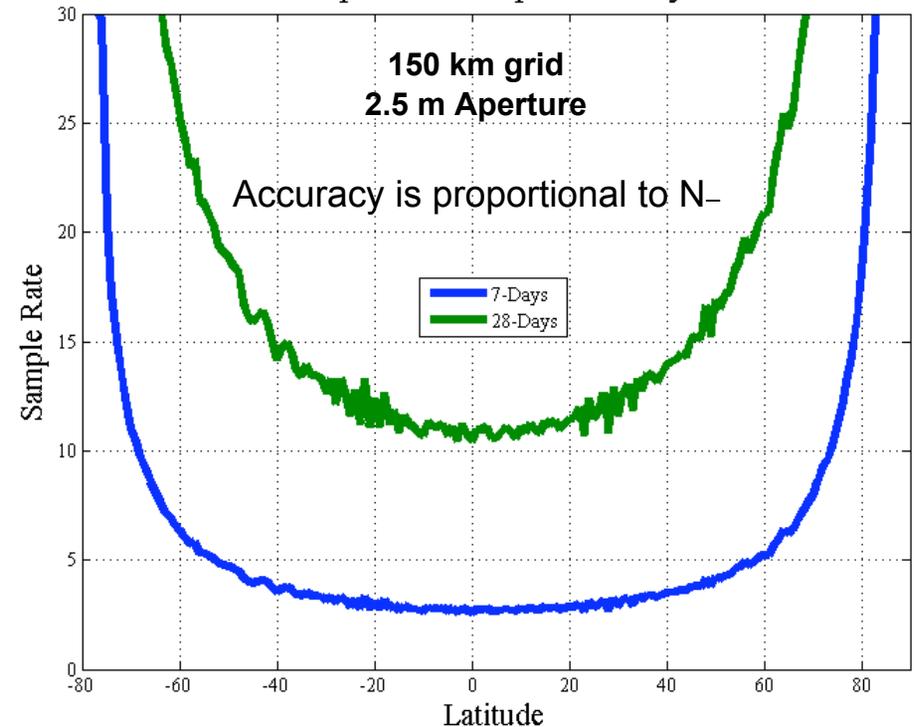


- Sensitivity is greater in low latitudes (SST effect)
- Sample density is greater in high latitudes (orbit effect)
- Error reduction from averaging more samples in higher latitudes partially offsets loss in sensitivity due to low SST.

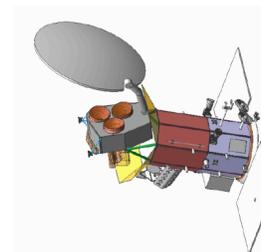
SST vs Latitude



Aquarius Sample Density



Baseline and Minimum Mission Flow



- The monthly average error increases gradually with latitude.
- The T_b allocation of 0.38K per observation yields 0.2 psu monthly global rms

Baseline Mission
0.2 psu Global RMS
150 x 150 km
Monthly

T_b per Observation 0.38 K

Minimum mission (seasonal average) T_b allocation is **0.66K** per observation

Aquarius Error Analysis Tool v3f	Brightness Temperature Error per Observation			Baseline Mission 3 Beams RMS (K)	
	PDR Allocation / CBE RSS (K)			Allocation	CBE
23-Jun-05	Margin RSS (K)			0.38	0.27
PDR				0.27	
Summary by Latitude Range	Latitude Range	Mean Sensitivity (dTv/dS)	Mean # Samples in 28 Days	Baseline Mission Monthly Salinity Error (psu)	
				Allocation	CBE
	0-10	0.756	10.9	0.15	0.11
	11-20	0.731	11.3	0.16	0.11
	21-30	0.671	12.1	0.16	0.12
	31-40	0.567	13.5	0.18	0.13
	41-50	0.455	15.9	0.21	0.15
	51-60	0.357	20.3	0.24	0.17
	61-70	0.271	30.2	0.26	0.18
Level 1 Requirement	Global RMS (psu)			0.20	0.14
	Margin RSS (psu)			0.14	